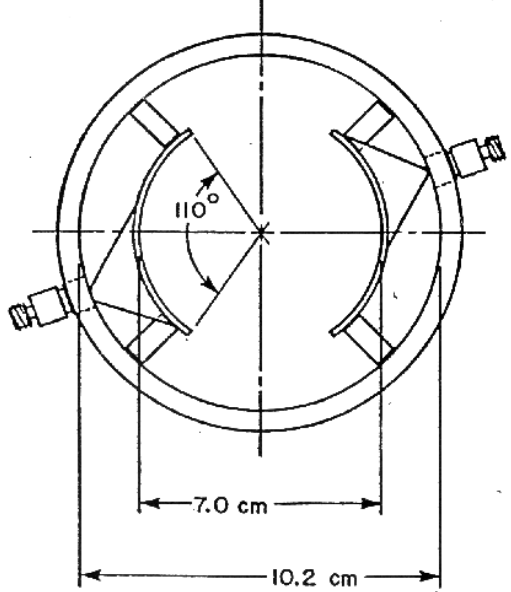


Tevatron BPM Upgrade

Stephen Wolbers

CD Briefing

February 4, 2004

Outline of this talk

- Project definition
- Management/organization
- Short history
- Project plan/wbs/effort/milestones
- Accomplishments so far
- Issues/concerns – where we are headed
- Summary

Project Definition

- The Tevatron BPM Upgrade Project will replace the current BPM electronics and the data acquisiton system used to transfer information between the BPMs and the Accelerator Controls Systems. As part of the project, the software used to read out, transfer, store, and analyze the BPM data will be upgraded. The goal of the project is to provide a BPM system based on modern hardware and software that gives the higher resolution and expanded functionality necessary to efficiently understand and operate the Tevatron Collider now and for the forseeable future. Deliverables of the project include all relevant documentation, manuals, users guides and any other written records necessary for maintaining the system.

  The project includes replacing the Tevatron BLM system interface hardware and software that is tightly coupled to the BPM system.

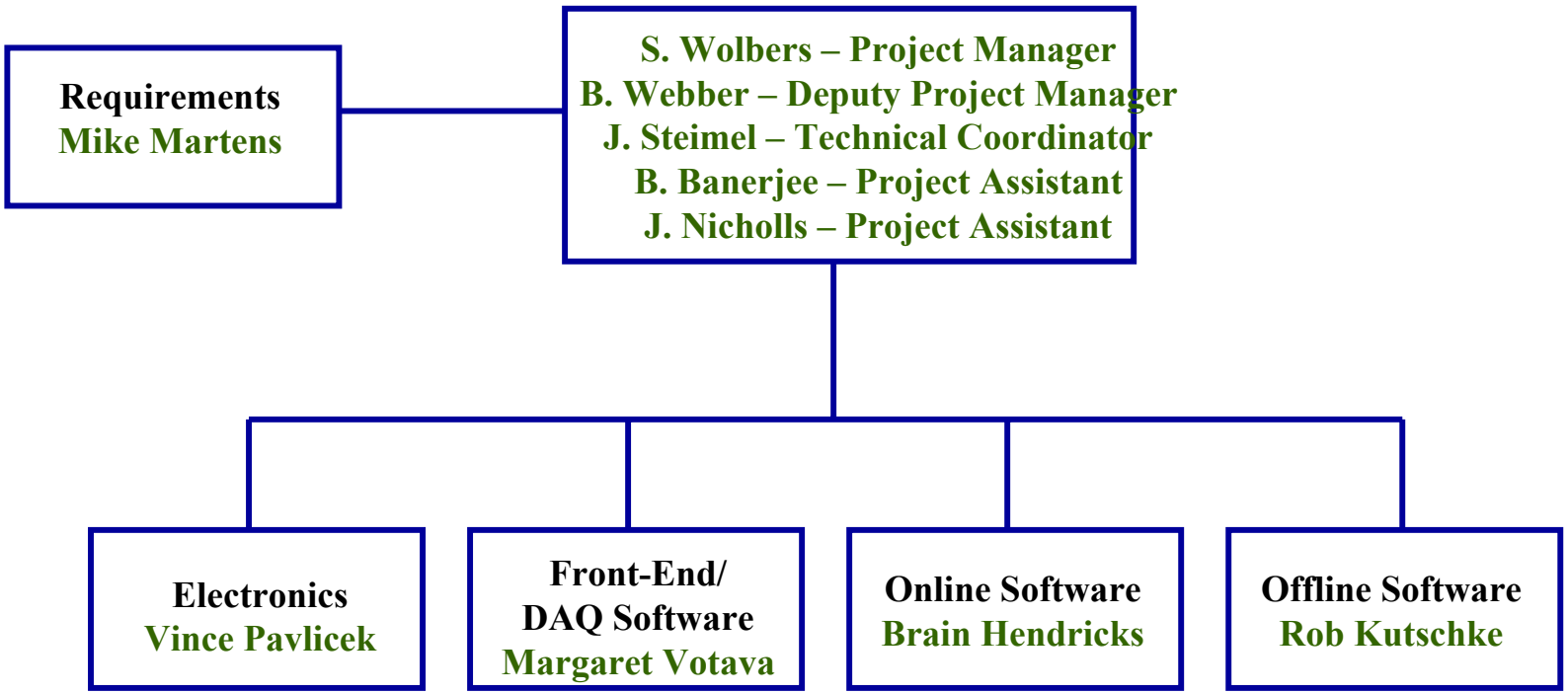
What is to be delivered by the project?

- All new electronics.
- Front-end software.
- Data to the online/controls system.
- Applications to use the new data.
- The pickups in the accelerator will not be modified!

Project management organization

- The project is a joint Accelerator Division/Computing Division project.
- It is a subproject of the Run 2 upgrade project, which is headed by Jeff Spalding and Dave McGinnis.
- We report to many people, and try to keep them all informed (and happy).
- It is highly likely (100%?) that the project will become an AIP project (Accelerator Improvement) shortly (but I said that in December).

Tev BPM Upgrade Project Organization



CD People Working on the Project

- Steve Wolbers, Bakul Banerjee, Judy Nicholls, Margaret Votava, Vince Pavlicek, Rob Kutschke, Mark Bowden, Bill Haynes, Luciano Piccoli, Dehong Zhang, Dinker Charak, Greg Duerling, Julia Yarba, Mark Fischler, Tom Boes, Mike Behnke, Bill Barker, Stu Bledsoe, …

AD/PPD People Working on the Project

- Bob Webber, Jim Steimel, Mike Martens, Brian Hendricks, Jean Slaughter, Joel Butler, Stephen Pordes, Marv Olson, Ken Koch, Brian Chase, Duane Voy, Jim Patrick, Al Baumbaugh, Judy Sabo, Fritz DeJongh, Eric James, …

Partial Project History

- Steve Wolbers joined the effort as Project Manager in mid-July, 2003.
  - This is the "project start" as far as I am concerned.
  - Lots of work was done prior to that time by many people and that should not be forgotten.
- August-September was spent getting "up to speed":
  - Most of us are not accelerator instrumentation experts
  - There was a need to talk the same language, understand the same concepts
  - There was also a large amount of vacation to deal with in this time-frame.

Partial Project History (2)

- September-December: serious planning and analysis toward picking a hardware solution and understanding the needs of the system.
- December-Now: Design, requisition writing, prototype measurements, test stands, etc.

Working with AD

- Working with AD is quite interesting.
  - Really good people.
  - They know the accelerator.
  - AD is a big division!
  - Sometimes it takes time to figure out who does what and how to interact.
- Bob, Jim, Mike, Brian have all been extremely helpful in getting us connected with the right people.

Project Planning

- A wbs has been developed for the project. There are 5 major "tasks" and 4 major subtasks in this structure.
- The 5 tasks are:
  - Development, Fabrication, Installation, Commissioning, Project Management
- The 4 subtasks are:
  - Electronics, Front-end Software, Online Software, Offline Software
    - Note that Requirements and Specifications are a part of the Project Management
    - Technical Coordination is new and will help to provide overall organization for the project

Project Planning - Cost

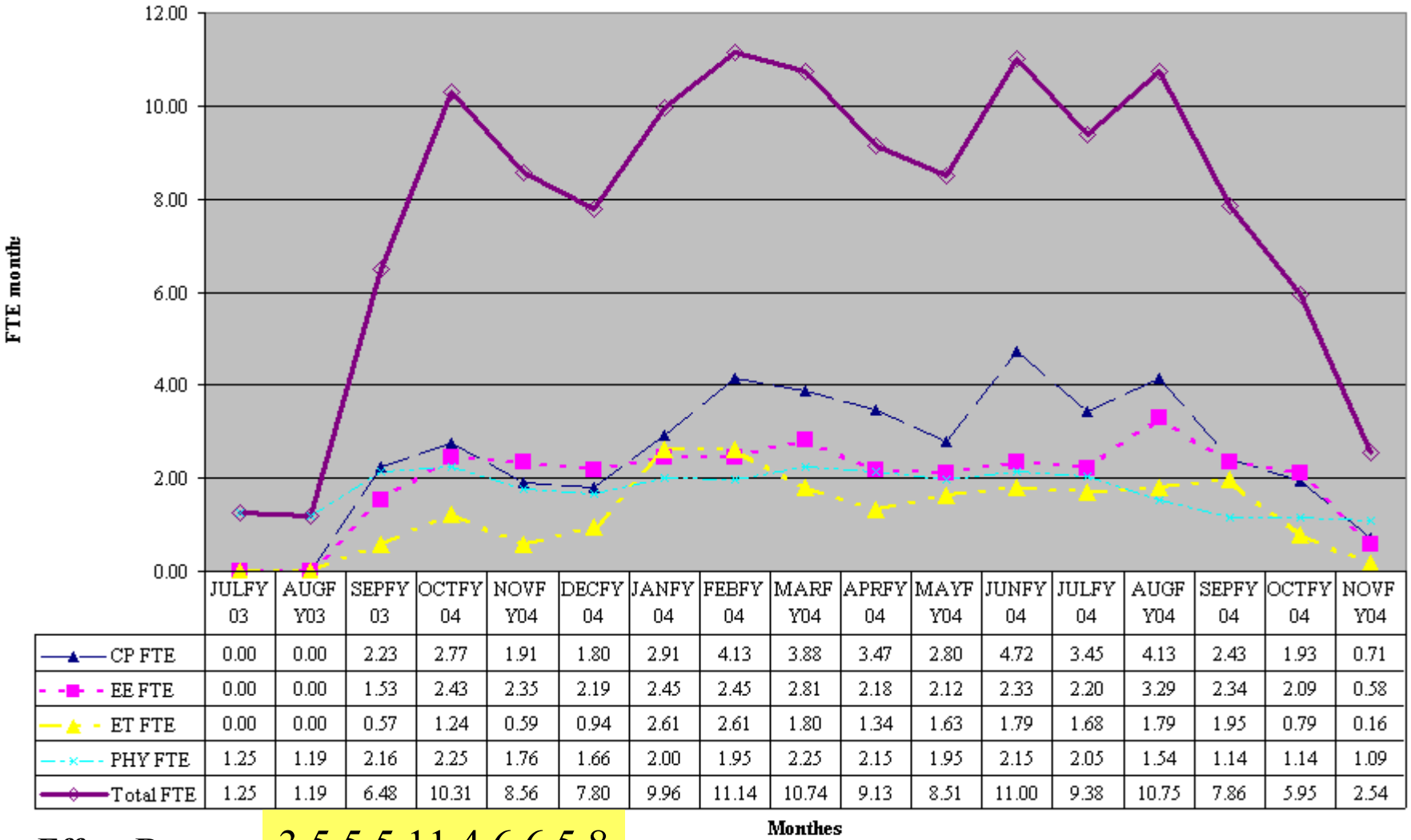
- The wbs is effort loaded and contains all M&S and SWF.
- Totals (not including overhead and contingency)
  - M&S: $1.66 Million
  - SWF: $1.0 Million <- may rise depending on the length of the project

Project Planning

- An important part of planning is the handoff to "operations" and the long-term support of the hardware and software developed as part of the project.
  - This is still undecided/unplanned in most cases.
- A roll up of the effort estimates shows a steady-state effort of about 10-11 FTE working until next autumn.

First complete wbs effort estimate

Not synchronized with The commissioning plan



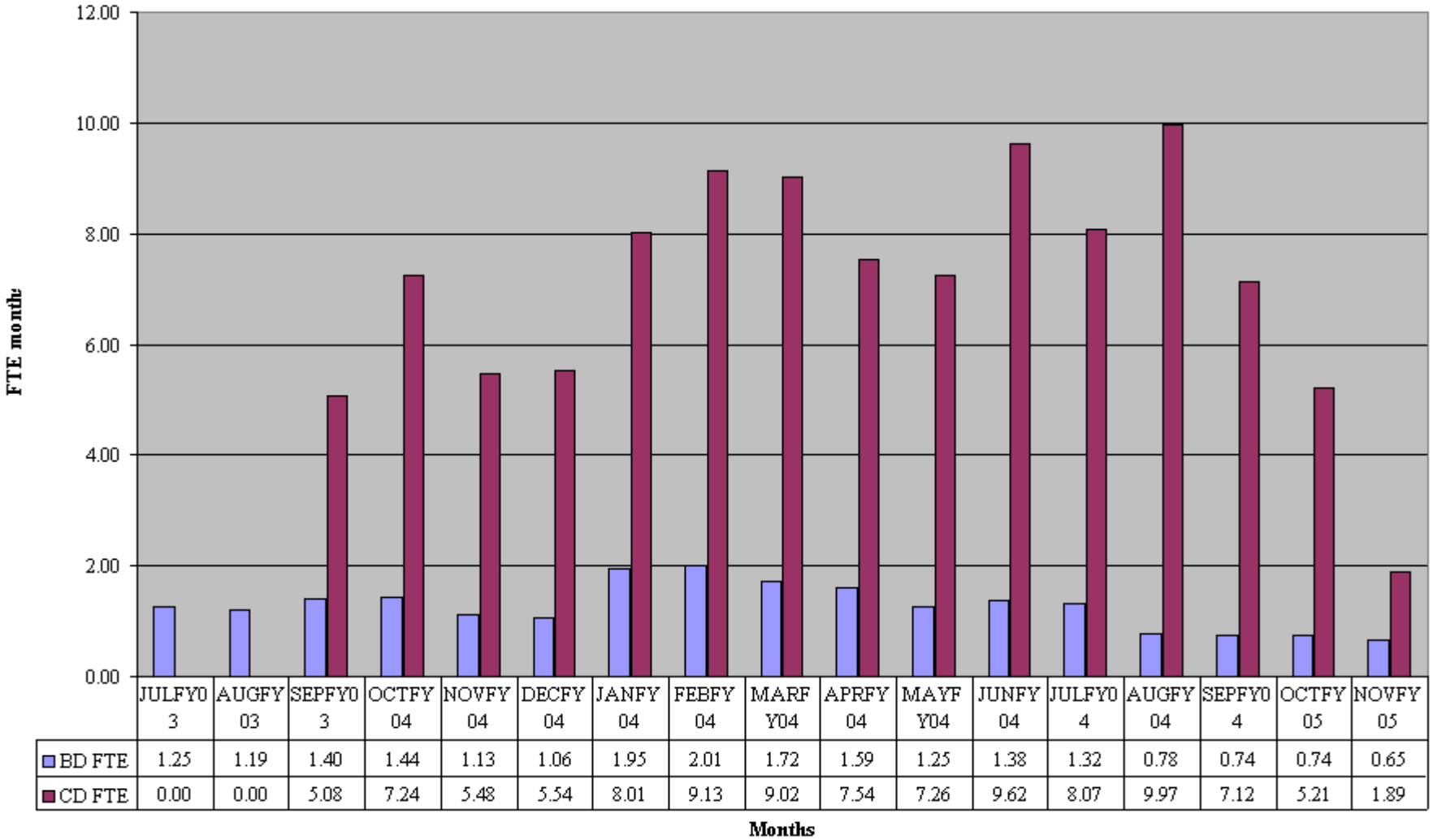
	JULFY 03	AUGF Y03	SEPFY 03	OCTFY 04	NOVF Y04	DECFY 04	JANFY 04	FEBFY 04	MARF Y04	APRFY 04	MAYF Y04	JUNFY 04	JULFY 04	AUGF Y04	SEPFY 04	OCTFY 04	NOVF Y04
CP FTE	0.00	0.00	2.23	2.77	1.91	1.80	2.91	4.13	3.88	3.47	2.80	4.72	3.45	4.13	2.43	1.93	0.71
EE FTE	0.00	0.00	1.53	2.43	2.35	2.19	2.45	2.45	2.81	2.18	2.12	2.33	2.20	3.29	2.34	2.09	0.58
ET FTE	0.00	0.00	0.57	1.24	0.59	0.94	2.61	2.61	1.80	1.34	1.63	1.79	1.68	1.79	1.95	0.79	0.16
PHY FTE	1.25	1.19	2.16	2.25	1.76	1.66	2.00	1.95	2.25	2.15	1.95	2.15	2.05	1.54	1.14	1.14	1.09
Total FTE	1.25	1.19	6.48	10.31	8.56	7.80	9.96	11.14	10.74	9.13	8.51	11.00	9.38	10.75	7.86	5.95	2.54

Effort Report: 3.5 5.5 11.4 6.6 5.8

Current estimated effort for the Project by Division

TBPM Estimated FTE By Division

Not synchronized with The commissioning plan



	JULFY03	AUGFY03	SEPFY03	OCTFY04	NOVFY04	DECFY04	JANFY04	FEBFY04	MARFY04	APRFY04	MAYFY04	JUNFY04	JULFY04	AUGFY04	SEPFY04	OCTFY05	NOVFY05
BD FTE	1.25	1.19	1.40	1.44	1.13	1.06	1.95	2.01	1.72	1.59	1.25	1.38	1.32	0.78	0.74	0.74	0.65
CD FTE	0.00	0.00	5.08	7.24	5.48	5.54	8.01	9.13	9.02	7.54	7.26	9.62	8.07	9.97	7.12	5.21	1.89

Div	Name	Effort(%)			
		Oct	Nov	Dec	Jan
AD	Chase Brian		13	10	20
	Dejongh Fritz	50	20		
	Hendricks Brian	20	15	10	20
	Koch Ken	100	0		
	Martens M.	20	20	20	20
	McCormick Jim	100	0		
	Olson Marv	90	0		
	Sabo Judy	100	0		
	Steimel J.	75	75	70	80
	Webber Bob	20	20	30	50
	Total AD FTE	575	163	140	
CD	BANERJEE	52	85	75	
	BARKER	75	0	0	
	BEHNKE	25	0	0	
	BLEDSOE	70	0	0	
	BOES	40	0	0	
	BOWDEN	25	30	25	
	CHARAK	0	20	6	
	DUERLING	0	0	10	
	FISCHLER	0	0	7	
	KUTSCHKE	60	60	35	
	NICHOLS	16	13	8	
	PAVLICEK	20	20	30	
	PICCOLI	60	65	60	
	VOTAVA	45	50	30	
	WOLBERS	50	50	50	
	YARBA		50	25	
	ZHANG	65	60	75	
	Total CD FTE	603	503	436	
	Total FTE	11.78	6.66	5.76	

Project Planning – Schedule
DOE Milestones

- 9/22/03 Tev BPM Requirements Review
- 12/16/03 Tev BPM Technology Review
- 2/13/04 Core Electronics PO placed
- 4/1/04 First modified board delivered
- 4/28/04 Electronics system design review
- 6/1/04 First Production Board delivered
- 6/15/04 First crate in Tevatron
- 9/10/04 All Echotek boards delivered
- 9/29/04 System complete and cabled
- 12/21/04 Commissioning complete

Internal Milestones

ID	WBS	Name	Duration	Pred.	Start	Finish
36	26.4.6.4.1.2.1	Begin SW design	1 d		9/2/03	9/2/03
32	26.4.6.4.1.1.7	Begin system commissioning plan	1 d		1/12/04	1/12/04
44	26.4.6.4.1.2.2	BPM SW specification-frontend DAQ - review cor	1 d	37	2/6/04	2/6/04
87	26.4.6.4.3.1.2	Timing card PO complete	1 d		2/13/04	2/13/04
71	26.4.6.4.3.1.1	BLM PO complete	1 d	70	2/16/04	2/16/04
98	26.4.6.4.3.1.3	BPM consolidated crate PO complete	1 d	78	2/16/04	2/16/04
59	26.4.6.4.1.3.2	BPM SW specification-online-review complete	1 d	58	2/24/04	2/24/04
63	26.4.6.4.1.4.2	BPM SW specification-offline-review complete	1 d	62	2/24/04	2/24/04
64	26.4.6.4.1.5	Tev BPM: SW Specification complete	1 d	44,58,6	2/25/04	2/25/04
55	26.4.6.4.1.2.3	BPM SW design - frontend DAQ - review complet	1 d	47	5/11/04	5/11/04
99	26.4.6.4.3.1.4	Promote Tevatron and FCC test stand to producti	1 d	81	6/2/04	6/2/04
108	26.4.6.4.3.2.2	Frontend DAQ implementation document - review	1 d	107	6/11/04	6/11/04
137	26.4.6.4.4.1.7	Design validation complete	1 d	135	6/15/04	6/15/04
118	26.4.6.4.3.3.2	Online SW code complete	1 d	114	6/16/04	6/16/04
125	26.4.6.4.3.4.2	Offline SW code complete	1 d	123	6/16/04	6/16/04
139	26.4.6.4.4.1.9	All Tev BPM crates functionally available	1 d	136	8/23/04	8/23/04
140	26.4.6.4.4.1.1	System commissioning plan complete	1 d	139	8/24/04	8/24/04
110	26.4.6.4.3.2.4	Frontend DAQ SW code complete	1 d	109	8/26/04	8/27/04
149	26.4.6.4.4.3.2	Online SW integration complete	1 d	148	9/15/04	9/15/04
153	26.4.6.4.4.4.2	Offline SW integration complete	1 d	152	9/15/04	9/15/04
157	26.4.6.4.5.1.1	Begin system commissioning	1 d		10/1/04	10/1/04
166	26.4.6.4.5.2.2	Frontend DAQ SW released	1 d	165	10/14/04	10/14/04
172	26.4.6.4.5.3.2	Online SW released	1 d	171	10/18/04	10/18/04
178	26.4.6.4.5.4.2	Offline SW released	1 d	177	10/18/04	10/18/04
185	26.4.6.4.6.4	End system commisioning with fully loaded HW/SV	1 d		11/11/04	11/11/04
186	26.4.6.4.6.5	BPM HW/SW system validation review	1 d	185	11/12/04	11/12/04

A Few Key Project Accomplishments

- Requirements document and review.
- Cable work in the tunnel during the fall shutdown to enable readout of the p and pbar ends of each BPM (using MR cables).
- BLM (Beam Loss Monitor) interface electronics prototyping.
- Measurements in A1 from Echotek and Damper Boards.
- P/pbar separation studies.
- Software specification for the DAQ, online and offline software.

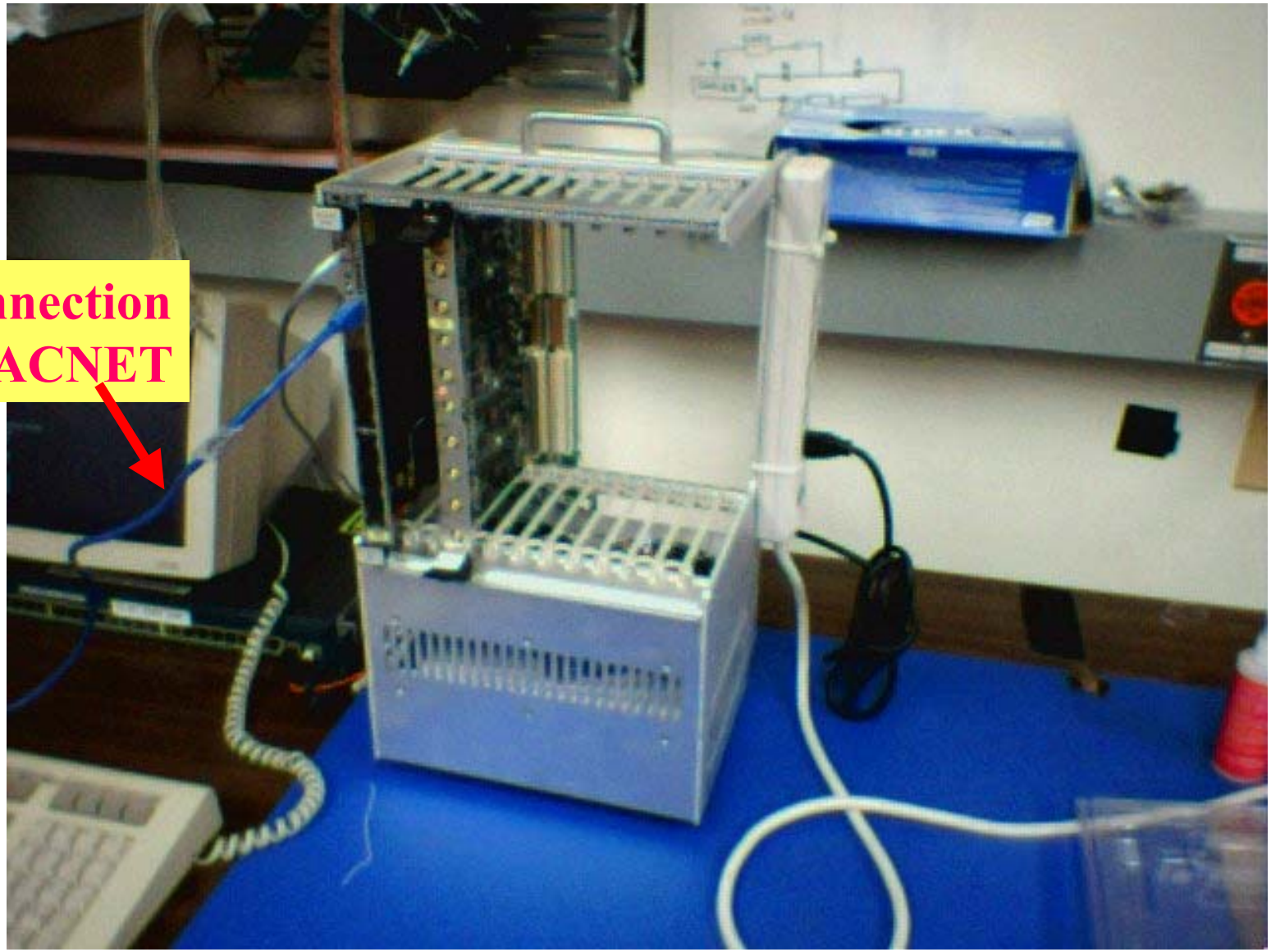
Cables ready for electronics

BPM Pickup Ports In the tunnel

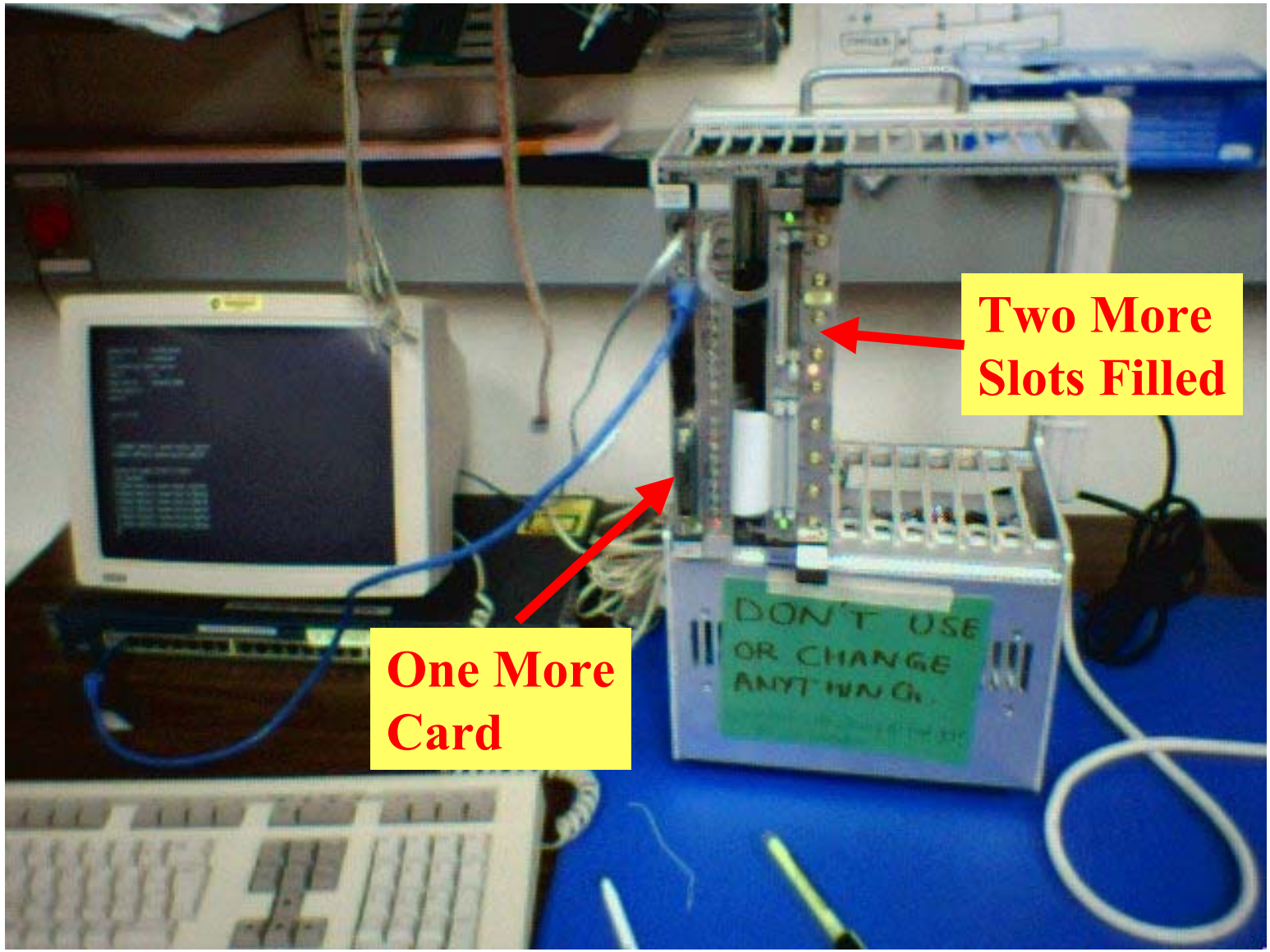
Test Stand in FCC

- Required ACNET and beam clock signals in FCC!
  - Thanks to CD Networking, Accelerator Division Controls and Networking, Margaret, Vince, others, it happened (and is still happening)
- The test stand will be an important part of the project, giving CD a dedicated place for tests (hardware and software)

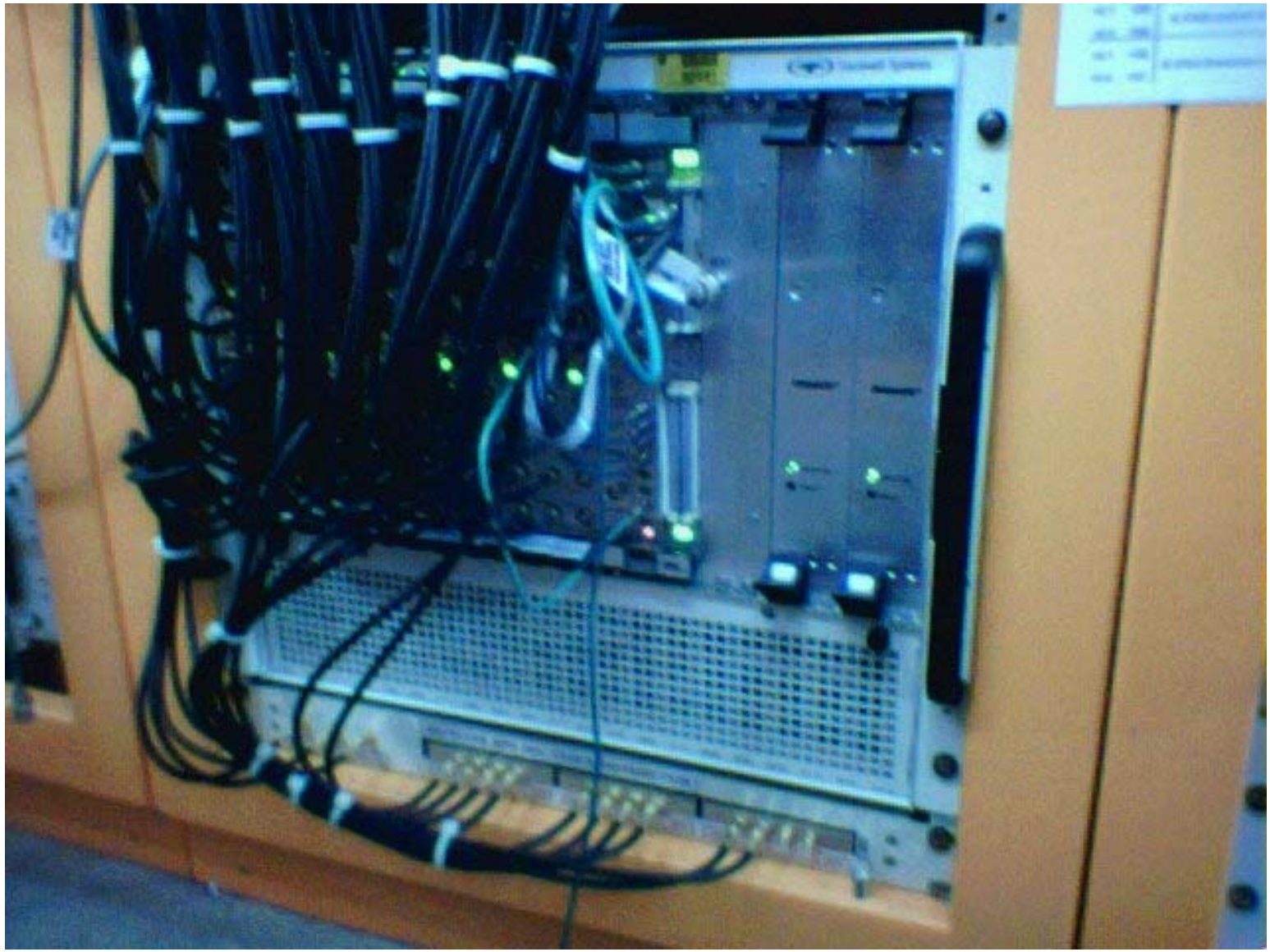
Test Stand in FCC3 – Last Week



Test Stand in FCC3 – This Week



Recycler Crate in AP60



Issues/Concerns

- **Aggressive Timescale**
  - October 1, 2004 was imposed as a goal for the project.
  - We are working hard to install systems starting in June, 2004.
  - Obviously it will be difficult to hold to this schedule but it is our goal and we will work hard to keep to the schedule.

Issues/Concerns(2)

- **Long Timescale**
  - Summer/fall shutdown may have an impact on commissioning
  - The draft commissioning plan does not allow commissioning during the shutdown.
    - This implies that the project will extend into late 2004/early 2005.
  - Other aspects of the project also will drive us to longer times
    - Full system commissioning
    - Application software
    - Full documentation

Issues/Concerns (2)

- Technological Challenges
  - Pbar measurement
    - This is an important part of the system requirements
    - We are still investigating whether and how we can make the pbar position measurement
    - Ideas include frequency domain p-pbar subtraction, timing, different hardware at key locations.
  - Off-axis and other corrections
    - To make full advantage of the improved resolution (x10 or more) of this system corrections will have to be made, probably in the offline software.

Issues/Concerns (3)

- Controls System/Database
  - Just beginning to explore the impact of the new BPM system on controls and databases.
  - There likely will be other issues to resolve
    - e.g. 10 Mbit shared in service buildings
- Offline Applications
  - We still have to define the scope of the project with respect to offline applications
  - Additional work would be the responsibility of the Tevatron department, the users of the system

Issues/Concerns (4)

- **BLM interface/new BLM?**
  - We have put the BLM part of the project on hold until we learn what is required/requested of the BPM system
  - The minimal requirement is that we carry the BLM systems through the BPM VME crate to the controls system.
    - Because we remove the old interface when we remove the old BPM hardware

Issues/Concerns (5)

- More BPMs (Main Injector, Transfer Lines)
  - The TeV BPM project has in its scope only the Tevatron BPMs (240)
  - The Main Injector and Transfer lines could use the same system.
  - There currently is no project organized to design and build those other systems.
  - There is some desire to continue this project to complete the other BPMs.

Issues/Concerns (6)

- AIP Project
  - Making this an AIP is non-trivial.
  - To do it right means getting the effort properly assigned and then charged.
  - Need to keep up with all expenditures, milestones, effort
    - But we're doing that anyway, by and large

Issues/Concerns (7)

- What does the project need from CD?:
  - People!
    - Engineers
    - Physicists
    - Computer Professionals
    - Technicians (especially for board checkout, installation)

Summary

- The Tevatron BPM Upgrade Project is a joint Accelerator Division-Computing Division Project and it is up and running.
- Our plan is to finish the design, acquire and install hardware and software, and hand off operations in 2004.
- There remains a great deal of work to accomplish all of the project goals.